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REALITY AND RELATIVITY OF SPACE AND TIME, IN META-PHYSICS AND MODERN PHYSICS

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Introduction

Human mind is an ocean of inquisitiveness and curiosity. Every now and then the waves of questions spring forth in it. Man tries to find answers to them by his rational, intellectual and intuitional power. Philosophy and Science are two powerful branches of the same stream of knowledge, which has been ceaselessly flowing to satisfy the curious mind of the man. Some of the questions tackled by Philosophy as well as by Science are regarding the nature of space and time. What are space and time? Do they really exist? Are they the forms of matters or Consciousness or some independent entities? etc.

A comparative study of the views of Philosophy and Science can be of great assistance in answering these questions. The well-known modern physicist, Sir Edmund Wittaker rightly remarks, "It is still true that many central philosophical questions cannot be discussed profitably without reference to the physical universe, and recent advances in physics have exhibited some classical philosophical problems in a new light. Among this is the question as to the nature of physical space[1]".

The different philosophies have given different solutions to the above problem. To give a full account of their efforts is a bit lengthy task. In this short paper, the concepts of Jain metaphysics, and modern physics are discussed and compared.

A. Jain Metaphysical Concept

In Jain philosophy, a very elaborate, characteristic and

1. *From Euclid to Eddington, p. 1.*

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systematic exposition of the theory of the universe is to be found. But we shall have to confine ourselves only to a brief review of its metaphysical exposition of space and time.

Space

Space, which is termed as *Ākāśa* is defined to be that substance which acts as a container of other substances. It is an independent objective reality different from matter, energy or consciousness. It is infinite in extent and is composed of infinite number of space-points. It is eternal in existence. It is immovable, continuous in texture, non-atomic and invisible. It is imagined to be divided into two parts, on account of the existence of other substances.

1. The portion of space, which is occupied by other substances is termed *Loka-Ākāśa i. e.* universal space.

2. The rest of space, which is empty is called *Aloka-Ākāśa i. e*, non-universal space.

Thus the universe is finite and is surrounded in all directions by the non-universe which is boundless. The problem of the finiteness of the universe is solved by the Jain theory thus : There are two substances, called *Dharmāstikāya* and *Adharmāstikāya* which terms can be translated as 'positive ether' and 'negative ether' respectively, for they are considered to be the indispensible media of motion and rest respectively. They exist only in the finite universal space and hence, no substence can move or be at rest in the non-universal space. That is in no condition or under no force, a sub-stance can travel or stay in the non-universal space.

The *Loka-ākāś* or the universe has a definite size and shape. Its volume is believed to be 343 cubic *Rajjus*, Rajju being an astrophysical unit. Though the value of a *Rajju*

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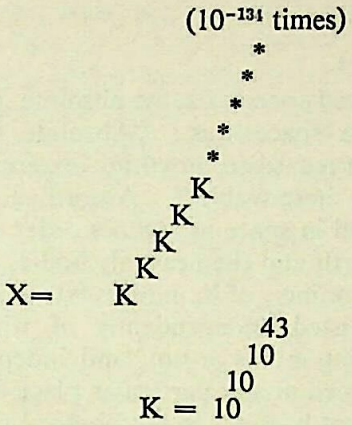
cannot be stated in round numbers, it is definitely greater than X light-years[1], where



where,

$$K = 10^{10^{10^{43}}}$$

The space of the *Loka-ākāśa* is similar to a solid figure consisting of three phyramids with rectangular base but with the tops chopped up, which are put one above another, smaller faces of the lowest and middle and the bigger faces of the middle and top touching together.

Time

While there is unanimity of opinion about the ultimate reality of space there is considerable disagreement amongst the Jains themselves regarding time. One school does not accept time as an ultimate reality, but maintains that the unceasing mutability of other substances like souls and matter, etc. is itself symbolised into an 'existent' called time. On the other hand, another school of thought considers it to be an ultimate reality. Both the schools, however, agree to the fact that the, *Samaya* is defined to be the indivisible unit of time. Though it is beyond our numeri-

1. For the discussion of Rajju, see the author's, *Visva Prahelika.*

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cal comprehension, it has a definite value[1]. Roughly speaking, one second is greater than 'X' *Samaya*, the number X being defined above.

B. Newtonian Concept

Newton conceived space as some absolute entity. His concept of absolute space was : "Absolute space, in its own nature, without regard to anything external, remains always similar and immovable[2]". According to Newton, "all things are placed in space as regards order of situation. It means that the earth and the heavenly bodies are situated in an immovable container, of boundless extent which exists, and has always existed, independently of whether it is observed by perceiving minds or not, and independently of whether it is occupied at any particular place or not ; it is the scene of all that happens in the physical universe ; at any instant, every material body is located somewhere in it, and has the possibility of changing from one location to another. Its size is infinite, its character uniform, its texture continuous, and its geometry Euclidean[3]".

Newton's concept of time was : "Absolute, true and mathematical time of itself, and from its own nature, flows equally without regard to anything external[4]".

C. Theory of Relativity and Modern Concept

After the advent of the theory of relativity, the concepts of space and time were changed. According to Dr. Einstein, "Space and time are forms of intuition which can no more be divorced from consciousness than our concepts

1. For the discussion of the mathematical computation of *Samaya*, see *Ibid.*
2. Principia Mathematic, Tr. By Mottee & Canjori, p. 6.
3. Cf. Sir Edmund Whittaker, from Euclid to Eddington, p. 13. Principia Mathematica, p. 6.

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of colour, shape or size. Space has no objective reality except as an order or arrangement of the objects we perceive in it, and time has no independent existence apart from the order of events by which we measure it[1]".

The philosophical interpretation of the theory of Relativity in Einstein's view is : "The universe is a four-dimensional space-time continuum, which is not simply a mathematical construction ; all reality exists both in space and in time, and the two are indivisible[2]."

Some scientists have interpreted the Theory of Relativity in a different way. According to Hans Reichenbach, "From conventionalism the consequence was derived that it is impossible to make an objective statement about the geometry of Physical space, and that we are dealing with subjective arbitrariness only ; the concept of geometry of real space was called meaningless. This is a misunderstanding. Although the statement about the geometry is based upon certain arbitrary definitions the statement itself does not become arbitrary : once the definitions have been formulated, it is determined through objective reality along which is the actual geometry. Let us use our previous example : although we can define the scale of temperature arbitrarily, the indication of the temperature of a physical object does not become a subjective matter. By selecting a certain scale we can stipulate a certain arbitrary number of degrees of heat for the respective body, but this indication has an objective meaning as soon as the coordinative of the scale is added. On the contrary, it is the significance of coordinative definitions to lend an objective meaning to physical measurement[3].

1. The universe and Dr. Einstein by Lincon Barnett, p. 21.
2. *Ibid* p. 76.
3. *The Philosophy of Space and Time, Page 37.*

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Thus although Reichenbach has accepted the Theory of Relativity, he has maintained that the absolute space and time have objective existences. In the concluding chapter of his work on space and time he observes :

"The statement that physical space has three dimensions, has therefore, the same objective character as, for instance, the statement that there are three physical states of matter, the solid, liquid and gaseous state ; it describes a fundamental fact of the objective world....."

"We may therefore regard the following statement as the most general assertion about space- time order : everywhere and at all times there exists a space-time coordinate system.

"This result implies the topological distinguishability of space and time. In a space-time, coordinate system one of the dimensions is to be considered as time and the three others as space....."

D. Newtonian Concept and Jain Concept

The Newtonian Concept of absolute space has striking similarities with the Jain Concept of *Ākāśa*. Both the concepts regard space as an independent objective reality which is single, continuous, infinite and immovable substratrum of all other substances and which exist even in the absence of the external substances. Nevertheless there is an important difference in the two Çoncepts. In the Newtonian physics, the problem of motion was tried to be solved by postulating a material and medium called 'ether' which was supposed to fill the whole space and act as the medium of all kinds of motions including the wave motion. On the contrary the problem of motion and rest is solved in Jain metaphysics by the principal of *Dharmāstikāya* and *Adhar-*

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māstikāya which are non-material media of motion and rest respectively. It was the postulation of material ether in Newtonian Concept, which was responsible for creating an insoluble enigma for the physicists, as a consequence of which they had altogether discarded in the new theory *viz.* The Theory of Relativity. But, as far as the question of reality of Newton's space is concerned, it can be said that its logical consistency is still unobjected. The renowned western philosopher, Bertrand Russell accepting this fact observes :

"The Newtonian theory of absolute space meets the difficulty of attributing reality to not being. To this Theory there are no logical objections. The chief objection is that absolute space is absolutely unknowable, and cannot therefore be a necessary hypothesis in an empirical science. The more practical objection is that physics can get on without it[1]."

Thus it becomes clear that Newton's theory of absolute space and the Jain theory of *Ākāśa* are irrefutable on logical basis. Newton believed that absolute, true and mathematical time exists : Jain metaphysics also asserts that the *Samaya* etc. are absolute mathematical time units. Thus both the concepts are quite akin to each other. There is, however, a slight variance in them. In Newton's physics, there is no conception of finite velocity of light, and hence it does not accept the space time relation which has emerged out because of the finiteness of the velocity of the light, whereas the Jain metaphysics has no objection to such relation.

E. Post-Einstenian Concept and Jain Concept

There are two aspects of the theory of relativity regarding the nature of space and time :

1. History of Western Philosophy, p. 90-91.

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1. The relativity of space and time.
2. The reality of space and time.

We shall first discuss the former.

The special theory of relativity of Dr. Einstein states : "It is impossible to determine the absolute motion of any uniformally moving system by any experiment whatsoever." On the basis of this theory it is usually interpreted that there is no existence of absolute space. If this is the true intrepretation, the Theory of relativity does not become consistent with the Jain metaphysics. But, fortunately, the above interpretation is not unanimously accepted, and it seems that it is not the true interpretation.

Subjective inability or Objective indeterminacy

First of all it is necessary to find out whether the impossibility stated in the theory of relativity is 'subjective inability' or 'objective indeterminacy'. If our inability to know the absolute motion of any system in uniform motion is in reality, the subjective inability then it does not mean that the absolute motion does not really exist. On the basis of the Jain metaphysical concept, it can be said that the said impossibility is a result of subjective inability, and not that of objective indeterminacy. Reinchenbach has very well explained this confusion in his welknown treatise. He observes :

"Thus we are accused of having confused subjective inability with objective indeterminacy".

"There are, indeed, many cases where physics is unable to make measurements. Does this mean that the magnitude to be measured does not exist ? It is impossible, for instance, to determine exactly the number of molecules in a cubic centimeter of air ; we can say with a high degree of

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certainty that we shall never succeed in counting every individual molecule. But can we infer that this number does not exist ? On the contrary, we must say that there will always be an integer which denotes this quantity exactly. The mistake of the theory of relativity is supposed to consist in the fact that it confuses the impossibility of making measurement with objective indeterminacy[1]". Thus it becomes clear that it would be wrong to infer on the basis of the theory of relativity that the absolute space has no existence at all.

Dr. Heisenberg on absolute space

One of the top-most physicists of our age, Dr. Heisenberg has also made an attempt to remove the above misunderstanding. He writes "the hypothetical substance 'ether', which had played such an important role in the early discussions on Maxwell's theory in the ninteenth century, had—as had been said before—been abolished by the theory of relativity. This is some time stated by saying that the idea of absolute space has been abandoned. But such a statement has to be accepted with great caution."

Thus although Heisenberg has not accepted that there exists an independent reality called space, he has at least, accepted that abolition of material ether does not mean abolition of absolute space. At another place, Heisenberg quotes an argument of the critics of the Theory of relativity. Here also though he has not accepted this view he has asserted :

"It is seen at once that this argument cannot be refuted by experiment, since it as yet makes no assertions which differ from those of the theory of special relativity[2]."

1. The Philosophy of Space and Time, p. 28.
2. Physics and Philosophy, p. 120.

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The argument of the critics of the theory of relativity is :

"The non-existence of absolute space and absolute time is by no means proved by the special theory of relativity. It has been shown only that true space and true time do not occur directly in any ordinary experiment ; but if this aspect of the laws of nature has been correctly taken into account, and thus the correct 'apparent' times have been introduced for moving co-ordinate systems, there would be no arguments against the assumption of an absolute space. It would even be plausible to assume that the centre of gravity of our galaxy is (atleast approximately) at rest in absolute space. The critics of the special theory of relativity might add that we may hope that future measurements will allow the unambiguous definition of absolute space (that is, of the 'hidden parameter' of the theory of relativity) and that the theory of relativity will thus be refuted[1]".

Prof. Margenau's Construct

Another Eminent Philosopher—scientist Prof. Margenau calls absolute space a possible 'construct', which is his term for 'reality'. He writes : "The advocate of absolute space bases his attitude on the simple fact that he can intuit three-dimensional space even when it is vacant of objects. This kind of space is a possible construct, and it is absolute within the frame-work of the initial question[2]".

Further, Prof. Margenau has explained that this kind of absolute space is not adopted by the scientist only because it is not useful to them. But it does not mean that the absolute space has ceased to exist.

The '*ākāśa*' of the Jain metaphysics is also an absolute

1. *Ibid. pp. 119-120.*
2. *The Nature of Physical Reality, p. 153.*

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space, and this theory of '*ākāśa*' cannot be refuted on the basis of the theory of relativity ; yet we have to accept that in the empirial science, such passive space is of no use, and hence, the physicists may not take account of its reality, as stated by Russell. Thus, we may conclude space is essential in the logical field, it is not so in the field of empirical science. It should be remarked here that the scientists are not able to solve some other aspects of the enigma of the universe probably on account of their abandoning the account of the absolute apace.

The Reality of Space-time

The second aspect of the theory of the relativity is regarding the reality of space and time. We have already seen that all the scientists are not unanimous regarding it. Whereas Einstein, Jeans etc. consider space and time as merely the intuition of consciousness; Reichenbach, Hiesenberg do not deny their reality to reach some definite conclusion. First of all it is necessary to clearly understand some scientific concepts, such as space, time four-dimensional continuum of space-time, gravitational field, metrical field, ether etc. It will be also fruitful to know their relation with the metaphysical concept of '*ākāśa*', time.

Dharma and Adharma

Einstein, etc. mean by space an 'order of things' : Reichanbach etc. conceive space as an independent reality, besides such an order ; the Jain metaphysics define *ākāśa* as an objective reality or real substance giving room to other substances. This concept of Jain metaphysics is quite different from the Einsteinian concept. But if we accept the Einsteinian concept, the problem of the substratum of the substances is not solved. We, therefore, on the logical grounds, have to abandon the Einsteinian concept; moreover

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the Einsteinian definition is not sufficiently clear. For the general theory of relativity unifies space with the gravitational field or the metrical field. Then space no more remains a mere order of things but takes the form of some reality or field which has curvature. Now the question is whether this field is an independent reality ? If the answer to this question is not in negative, then this field would be probably not much different from the 'real space'.

It is generally believed that such a field or curvature is generated only due to the presence of the mass of the substances. That is to say anything possessing 'mass' creates a gravitational field around itself, just as a magnet creates a magnetic field or an electric current creates an electromagnetic field around it. If this is so, the gravitational field cannot be considered as an independent reality. But this is not strictly true even in absence of matter or mass, there exists a sort of residual curvature or field in the space. This is clearly expressed by Sir Arthur Eddington, the renowned physicist thus ; 'in a region where there is no recognised matter or electromagnetic field, there is still a certain small natural curvature, *viz.* that specified by the famous "cosmical constant". The mass, momentum and stress equivalent to this curvature ought therefore to be ascribed to whatever we suppose to occupy such a region, *i.e.*, to the space, field or ether[1] whichever term we are using[2]. This question makes it clear that even in complete

1. Sir Arthur Eddington has given a clear conception of ether. According to him the theory of relativity has abolished the material ether but a non-material ether still exists. Also he believes that there is no space without ether and no ether which does not occupy space. Thus, he makes ether, space and metrical field a single thing.
New Pathways in science p. 38-41.

2. *New Pathways in Science p. 47.*

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vacuum there exists something which we have to consider as an independent reality. The '*Akāśa*' of Jain metaphysics may be even different from this. The twin ethers Dharma and Adharma seem to be responsible for this natural curvature of space. Though we cannot say anything certainly about this, at least it becomes clear that the Einsteinian definition of space falls short in this respect. Also the above discussion makes it clear that the concepts of '*Ākāśa*' which is given by the Jain metaphysics is not fulfilled by the concepts of space, ether or field of the modern physics.

Now we shall consider the curvature or field, which is different from the natural curvature denoted by the cosmical constant, and which is created by the masses. The general theory of relativity proposed by Dr. Einstein is supposed to replace the Newton's Law of Gravitation by its Law of Curvature of Space. According to this law, the properties of space or even the existence of space depends upon the material bodies and energy or masses that are present. Where there is a mass, field or space is generated around it. If the mass is removed from that place, the field or space is also removed. In other words, as said before this field is connected with the mass in the same way as the magnetic field is connected with a magnet. The philosophical interpretation of this phenomenon would be that a gravitational field or metrical field is essentially an attribute of matter and not an independent reality in itself. Hence it is clear that the realities represented by *Ākāśa*, *Dharma* and *Adharma* of the *Jain* metaphysics are quite different from this gravitational field produced by a mass.

Next we shall consider the concept of four-dimensional continuum of space and time. This Einsteinian concept is a bit difficult to be understood. As said before

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Einstein, Jeans etc. consider it not to be an objective reality. The universe, in their view, is nothing but a four-dimensional continuum of space and time. Also, they believe that the universe consist not of things but of events and that these events are the various modes of the four-dimensional continuum of space and time. Such a picture of the universe is certainly quite confusing. On the one hand it is believed that the matter causes curvature in the four-dimensional continum. This belief is clearly expressed. In the following anology : Just as a fish swiming in the sea agitates the water around it, so a star, a comet, or a galaxy distorts the geometry of the space-time through which it moves."[1] On the other hand all these objects which constitute the universe are taken to be the modes of the four-dimensional continuum itself. Such ambiguous concepts have weakened the philosophical or more precisely the metaphysical aspect of Einstein's theory. Contrary to this, Reichenbach's concepts are quite clear. He accepts the fact that space, time and matter are related to each other, but at the same time he does not deny their independent existences. Also it is his clear view that calling time a dimension of space on the basis of the concept of the four-dimensional continuum would be wrong; he remarked "whereas the conception of space and time as a four-dimensional manifold has been very fruitful for mathematical physics, its effect in the field of epistemology has been only to confuse the issue. Calling time the fourth dimension gives it an air of mystery."[2] He concludes : "We may therefore retain the perpetual difference between space and time without fear of contradicting the mathematical representation.....The properties of time which the

3. *The Universe and Dr. Einstein, p. 76.*
1. *The Universe and Dr. Einstein, p. 92.*
2. *Philosophy of Space and time, p. 110.*

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theory of relativity has discovered have nothing to do with its treatment as fourth dimension."[1]

The Jain metaphysical concepts are more logical and clear than Einsteinian concepts. By accepting the *Pudgala* (*i.e.* matter), *Ākāśa*, (*i.e.* space) and *kāla* (*i.e.* time) as independent substances the Jain theory does not seem to contradict the theory of relativity. The Jain view is that the material attributes of *pudgala* such as mass, motion etc. should have no effect on the structure of *Ākāśa*. On the basis of the Jain concept, it can be said that the gravitational field etc. generated by the matter or material effects should be material and hence the changes, modifications brought about thus also should be connected with matter and not with space.

Russell's Conceptual Space

Russell's theory of space is of great value in understanding the confused concepts of the scientists. He, in the conclusion of a philosophical discussion on space, states : "We have, on this view, two spaces, one subjective and one objective, one known in experience and the other merely inferred. But there is no difference in this respect between space and other aspects of perception, such as colours and sounds. All alike, in their subjective forms, are known empirically; all alike in their objective forms are inferred by means of a maxim as to causation. There is no reason whatsoever for regarding our knowledge of space as in any way different from our knowledge of colour and sound and smell.[2]"

The two kinds of space interpreted by Russell can be

1. *Ibid, p. 112.*
2. History of Western Philosophy, p. 744.
3. Df. Margenam, The Nature of Physical Reality, p. 457.

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called perceptual space and conceptual space. The Jain metaphysical *Ākāśa* can be compared to the conceptual space of the Russell, while the space of the physicists is akin to the perceptual space of Russell. But, on logical basis without accepting the reality of conceptual space, the problem of substratum of substances cannot be solved.

Zenos Nest of Space

The Jain metaphysical concept of *Ākāśa* is based on the logical necessity of the substratum of all the substances. Against such a concept the general arguments which is the well-known paradox of Zeno, is as follows: "If all that exists were in space, space also would have to exist in space and so *ad infinitum.*" The answer to this argument is as follows: If the substratum of the other substances is conceived to be a material substance, there would be a fallacy of regressus *ad infinitum,* for experience tells us that any material substance cannot stay without a subsratum. We, therefore, have to conceive of some non-material substratum. Thus *Ākāśa* or space which is a non-material substratum is defined as that substance which is self-supported and which can support other substances. Hence we need not think of any other substance to support the space.

Thus we can conclude that the Jain metaphysical concept of *Ākāśa* is not only irrefutable by the theory of relativity but also unobjectionable on logical grounds.

Physical Aspects of the Theory of Relativity

After having discussed the philosophical aspect of the theory of relativity, now we shall discuss some of its physical implications.

Shape of the Universe

Einstein's theory of the universe imply that the universe

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have no definite shape. This is expressed by Lincon Bernett thus : "And the most remarkable of these assumptions is that the universe is not a rigid and immutable edifice where independent matter is housed in independent space and time; it is on the contrary an amorphous continuum, without any fixed architecture. Wherever there is matter and motion, the continuum is disturbed." Such a picture of universe does not seem to be logical, for, if the total mass of the universe is constant, its effect on the four-dimensional continuum also should remain constant. Even when a body moves in the space from one place to another place there is no change in the total mass contained in the universe. Hence, the total curvature of the universe which should depend upon the total mass contained in the universe, should remain constant and subsequently, there should be no change or distortion in its architecture.

The Jain theory also states that the shape of the universe which is in fact the shape of the *Loka*, *Ākāsa*, *Dharma* and *Adharma* rèmains the same in spite of the motion of the masses inside it.

Fitzgerald Contractions

One of the important implications, of the theory of relativity in the field of physics is the contractions in space and time—dimension which are popularly known as Fitzgerald Contractions. Their mathematical values can be found by the Lorentz equation. According to this theory of contractions, when a system moves, there occurs a contraction in the space-and-time-dimensions. In other words, the length of the moving body contracts in the direction of the motion and a clock placed in such a system moves slowly. Such contraction in the length of the moving body, is generally spoken of as the contraction in space. Now, if

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we consider it to be the contraction of the real space, it would not be correct. For this contraction is the result of the change in the state of the material substance, and not that of the non-material entity like space in which the material body exists.

The contraction in time-dimension is a bit more difficult to comprehend. Let us take a simple illustration : Imagine that a star is 40 light years away from the earth. Now, if a rocket moves with the speed of 240,000 Kilo meters/second, how much time would it take to reach from the earth to the star ? The theory of relativity gives two answers to this question :—

(1) For the observer on the earth, the rocket will take

$$\frac{300000 \times 40}{40000} = 50 \text{ years}$$

to reach the star (300000 km./sec. is the velocity of light.)

(2) For the passenger who is travelling in the rocket there will be a contraction in the time-dimension according to the laws of Fitzgerald Contraction. This contraction will be in the ratio of 10 : 6 *i.e.* for the passenger in the rocket, it will take :

$$\frac{50 \times 6}{10} = 30 \text{ years to reach the star.}$$

This illustration explains the contraction in time-dimension. But, there is still a confusion in the philosophical aspect of this contraction. The question arises whether the natural processes of man (one of which is his age) are affected by this contraction, that is to say, whether the natural processes of man will take place according to the contraction in time created by his motion ?

The scientists are probably not unanimous regarding

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its answer. Prof. Margenau, for example, states: "That the length of rigid bodies is different when it is measured by an observer moving relative to these bodies from what it is when measured by an observer at rest with respect to them. Similarly, clocks have their tempo changed when read by moving observers. These are empirical facts which are not subject to metaphysical interpretation; they are true and real in every ordinary sense of these words.[1]" Contrary to this, the famous physicist Sir Arthur Eddington in answer to the above question writes : "In the early days of the theory of relativity one of the most frequent questions asked by my correspondents was, 'Is the Fitzgerald Contraction real or apparent ? Is it really true that a rapidly moving rod becomes shortened in the direction of its motion ? The answer which I have in the *Nature of the Physical World* (pp. 32-34) given is too long to quote here; but having pointed out with an example that we often draw a distinction between things which are "true" and things which are "really true", I explained that on the same principles the contraction of the moving rod would be described as true but not really true[2]."

This statement of the renowned scientist makes it clear that the contraction in space and time are not real from the point of view of absolute truth. Our common sense also forbids us to believe that the age of man travelling in rocket will increase with his velocity. Thus, we can say that the absolute units of space and time have real existence, and that they are not affected by the external phenomena of motion, etc. If this had not been the case, how the velo-

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1. *Nature of Physical Reality, p. 149.*
2. *New Pathways in Science, p. 278.*

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city of light, would remain absolutely constant? For velocity is measured in space units per time-units.

The above contractions, when considered in the light of Jain metaphysics, seem to be only material changes, for only material changes can be relative and the ultimate units of space and time are absolute.

Space and time related to each other

In the theory of relativity space and time are related with each other, because of the finite velocity of light. Heisenberg has explained in this way: "In the theory of relativity we have learned that the situation is different: Future and past are separate by a finite time interval the length of which depend on the distance from the observer. Any action can only be propagated by a velocity smaller than or equal to the velocity of light. Therefore, an observer can at a given instant neither know of nor influence any event at a distant point which takes place between two characteristic times. The one time is the instant at which a light signal has to be given from the point of the event in order to reach the observer at the instant of observation. The other time is the instant of the observation, when it reaches the point of the event. The whole finite time interval between these two instants may be said to belong to the 'present time' for the observer at the instant of observation[1]." Thus it becomes clear that the knowledge which we obtain through our senses and external equipment cannot be obtained faster than the velocity of light. Hence, the definition of simultaneity, also depend upon the spatial distance between the event and observer. Consequently in any event the space and time becomes related to each

1. *Physics & Philosophy, pp. 102-3.*

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other. So far, it is unobjectedly acceptable. But the question whether the velocity of light is the maximum possible velocity or not, is certainly not uncontroversial.

It is a fundamental assumption of the theory of relativity that the velocity of light is the maximum possible velocity. Now, if we examine this assumption in the light of Jain metaphysics, we find that this assumption is not strictly true. According to the Jain theory, out of the six substances constituting the universe, only matter and soul are capable of moving. The soul besides capable of moving in space from one place to another, is also capable of getting knowledge of the things situated at far distances without taking help of the external means. The actual motion of soul takes place when any living thing moves from one place to anther, when a soul transmigrates from one body to another, when an emancipated soul transverses to the end of the universe and also when gods or persons with special powers travel with high speeds from one place to another. The epistemological motion is not the actual change of place in space but in it the soul perceives intuits or transcends a distant object by its epistemological powers. In both the types of motions, a soul can travel at a velocity higher than that of light. In the transmigration a soul can travel with a maximum velocity of one Rajju per one *Samaya*. Also, in epistemological motion, an omniscient soul can transcend an object *Rajjus* away within a *Samaya*.

The above is the possibility of the velocity of soul. Now, the matter is also capable of moving with surprising speeds. The ultimate indivisible particle of matters known as *paramāṇu* (the ultimate atom) is also capable of moving with a velocity of 14 Rajjus/Samaya. This is the maximum velocity of matter.

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Now, if we examine the theory of relativity in the light of the above facts, we find the fundamental assumption of the theory of relativity may not hold good in microcosmos. Another interesting thing is that in accordance with the theory of relativity, the velocity of anything may become greater than that of light, if it has no mass. The Jain metaphysics asserts that the ultimate atoms and certain types of bodies composed of infinite number of the ultimate atoms are completely massless. Mass according to the Jain theory is not the fundamental property of matter. Thus, if such massless bodies travel with a velocity greater than that of light, the theory of relativity would have to accept it.

We may also note here that the modern age, together with the developments of the techniques of space-travelling, the mind of the scientists are eager to cross the speed limit set by the velocity of light. In one of the advanced scientific works on the exploration of space, Arthur Clarke expressing this possibility writes : "Before closing this chapter we must deal with two questions which any discussion of interstellar travel inevitably raises. In the first place, despite the categorical remarks made a few pages ago, can we be absolutely certain that the speed of light will never be surpassed ? The theory of relativity is, after all, only a theory. May it not one day be modified, just as it modified Newton's Law of Gravitation, which had remained inviolate for centuries and was generally regarded as being absolutely correct ?

Any attempt to answer this question would lead us into the deep waters of Philosophy and would involve such ideas as the fundamental structure of space and time. It is doubtful if anyone alive to-day could contribute much of real

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value to such a discussion : the verdict must be left to the future."[1]

The above question supports the plausibility that the barrier of velocity of light may be practically overcome one day and if it actually happens, the foundation on which the theory of relativity stands, itself would fall to the ground.

Macrocosmos and Microcosmos

The truthfulness of the theory of relativity will probably be certified only when the law of the macrocosmos would hold good in the microcosmos. The amount of knowledge about the microcosmos possessed by the present day physics is also quite small.

In such a condition nothing can be said finally about the truthfulness of the laws of physics. As far as the theory of relativity is concerned, its experimental basis is also not satisfactorily strong. The renowned atomic physicist, Werner Heisenberg himself has accepted this fact thus : "In the present state of astronomical observations the questions about the space time geometry on a large scale cannot yet be answered with any degree of certainty. But it is extremely interesting to see that these questions may possibly be answered eventually on a solid empirical basis. For the time being even the general theory of relativity rests on a very narrow experimental foundation and must be considered as much less certain than the so called special theory of relativity expressed by the Lorentz transformation..."[2]

In the articles and the books written on this aspect of science often it is expressed that the future experiments of science disprove the laws of the past, it would not be much

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1. The Exploration of Space, p. 175

1. Physics & Philosophy, p. 111

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surprising. In one of such articles Robert C. Cowen has expressed a doubt about the theory of relativity. He remarks :

"Thus even though the experimental basis of relativity has been substantially strengthened, physicists will continue to ask in this larger context—Was Einstein right?"[1] Cowen has tried to show in his article that in spite of the experimental verification of the theory of relativity, its certainty will always be doubted.

Even if we neglect the views of other scientists regarding Einstein's theory, we cannot neglect Einstein's own wordings where he frankly states :

"No amount of experimentation can ever prove me right, a single experiment may at any time prove me wrong". This statement, on the other hand, shows the humbleness of this great scientist, whereas on the other hand, it also clearly manifests the imperfectness of science.

The whole discussion may be summarised as follows : Firstly the veracity of the concepts of space and time based on the theory of relativity is not unequivocal ; secondly, its philosophical interpretation is not uncontrovertible. The philosophical concepts of Einstein etc. are not clear and logical.

The Jain metaphysical theory presents more consistent and logical concepts of the space and time. In fact the Jain theory is a philosophy of existence. The origin of its concepts and theories are not reason but intuition and transcedental knowledge in which the reality is directly experienced. Logic can only be a criterion for its theories. The why of reality probably may never be known through reason,

1. *"Was Einstein Right ?" in Bharat Jyoti, Bomay, 31st July 1963.*

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physical equipments or sensory knowledge. Prof. Margenau has rightly remarked somewhere in the end of his famous work on the nature of reality: "I know how in wise it is now-a-days to write systematic philosophy—the why of experience and hence the why of reality are problems it does not endeavour to solve. To be sure, reality can have no cause in the physical sense of the world. This invalidates our phrasing of the questions but not its meaning. At this point, the scientist bows out, and the philosopher of existence enters the scene".[1]

आम्नाय-ग्रन्थालय,
वाराणसी-५

1. *The Nature of Physical Reality, p. 458.*

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